

| h m | | | | | |
|-----|----|---|---|----|-----|
| 12 | 42 | Mr. Reynolds observed 16 meteors in a minute. | | | |
| 12 | 43 | " | " | 28 | " " |
| 12 | 44 | " | " | 27 | " " |
| 12 | 45 | " | " | 21 | " " |
| 12 | 46 | " | " | 25 | " " |
| 12 | 47 | " | " | 24 | " " |
| 12 | 49 | " | " | 31 | " " |
| 12 | 52 | " | " | 17 | " " |
| 12 | 53 | " | " | 20 | " " |
| 12 | 54 | " | " | 22 | " " |
| 12 | 55 | " | " | 20 | " " |
| 12 | 56 | " | " | 20 | " " |
| 12 | 59 | " | " | 34 | " " |

Between 1 o'clock and 1.20 I noted 33, 37, 33 meteors per minute.

Mr. Reynolds at the same time, looking in an opposite direction, noted 31, 29, and 30 in the same minute, consequently about 64 meteors were noted by two observers in the same minute. I was looking towards *Leo*; Mr. Reynolds to the point diametrically opposite.

| h m s | | | | |
|-------|----|---|--|--|
| At 1 | 50 | 0 | I and Mr. Reynolds only observed together 25 meteors in the minute. | |
| At 2 | 25 | 0 | One observer looking towards <i>Leo</i> and the other in a direction diametrically opposite, observed together only 3 meteors in a minute. | |
| At 2 | 27 | 0 | There were observed 14 in a minute. | |
| 3 | 9 | 0 | Two observers, placed as before, observed 11 meteors in the minute. | |

Observations of the Meteoric Shower of November 13-14, 1866, made at the Radcliffe Observatory, Oxford. Communicated by the Rev. R. Main.

Owing to the uncertainty of the exact time of the expected meteoric display, a strict watch was kept up during the night of Monday, Nov. 12, as well as during the whole of the following night of Nov. 13, when it actually occurred.

Up to the very time when the meteors began to appear with frequency, that is, till about 11 o'clock, the appearance of the sky was unfavourable. The afternoon was clear, but shortly before 11^h, clouds suddenly made their appearance, and it began to rain. The clouds, however, quickly disappeared, and, though they interfered occasionally with the observations, they did not prevent materially the observing of the phenomena.

Mr. Lucas began to observe a few minutes after 11^h, and

was joined by Mr. Quirling at midnight, and for about half an hour after this it was possible to make notes of the locality and appearance of the meteors, but afterwards the numbers increased so rapidly that it was impossible to do scarcely any thing more than count them.

The following is an abstract of the observations of individual meteors:—

| Approx. Greenwich M.T. | | | Constellation or Place of Appearance. | Direction. | Magnitude as compared with Stars. | Colour, &c. | Notes. |
|------------------------------|----|----|---|---|--|----------------|--|
| h | m | s | | | | | |
| 11 | 9 | | Gemini | { E. to S. upwards about 45° } | 2 | Red | |
| | 15 | | " | E. to S. | 2 | White | |
| | 25 | | " | E. to S. | 1 | Red | A long train; disapp. hidden by the tower. |
| | 28 | | " | W. | | Red | A long train. |
| | 29 | | " | E. to S. | 1 | White | A long train. |
| | 30 | | Eridanus | E. to S. | 1 | White | Motion downwards. |
| | 32 | | Ursa Major | E. to S. | 3 | White | Motion upwards. |
| | 35 | | Gemini | W. | 2 | White | |
| | 38 | | Ursa Minor | W. | 2 | Red | |
| | 40 | | " | W. | 3 | | |
| | 44 | | Ursa Major | W. | 3 | .. | To this time the observ- ations were made on the grounds at the south front of the ob- servatory. After this Mr. Lucas removed with the chronome- ter to the terrace out- side the octagon room. |
| | 55 | | " | Vertically | 3 | | |
| | 56 | | Lynx | S | 2 | Red | |
| | 58 | | Gemini | S. | 2 | Red | |
| | 59 | | " | S. | 1 | Red | Two very near each other seen at an inter- val of one second; they moved in parallel paths over Orion. |
| 12 | 2 | 50 | Ursa Major | W. | 2 | Red | |
| | 2 | 50 | " | W. | 2 | Red | |
| | 3 | 40 | Draco | W. | 3 | | |
| | 4 | 10 | " | | 2 | Red | |
| | 5 | 20 | " | | 2 | Red | |
| | 6 | 30 | Cancer | S. | 1 | Red | Up to this time Mr. Lu- cas had counted 14 small meteors which he had not time to register. |
| | 6 | 30 | " | | 1 | | |
| | 7 | 30 | Leo | S. | 1 | | |
| | 7 | 55 | Ursa Minor | W. | | | |
| | 7 | 55 | " | | 2 | | |
| | 8 | 50 | Ursa Major | W. | 3 | | |
| | 9 | 25 | Orion | W. | 1 | | Motion downwards. |
| | 9 | 45 | Ursa Major | W. | 2 | | |
| 10 | 30 | | Draco | W. | 2 | | |
| 10 | 30 | | " | W. | 2 | | |
| 10 | 40 | | " | W. | | | |
| 10 | 40 | | " | W. | | | |
| 11 | 47 | | Leo | W. | | | |
| 12 | 5 | | Ursa Major | W. | | | A train. |

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| Approx. Greenwich M.T. h m s | Constellation or Place of Appearance. | Direction. | Magnitude as compared with Stars. | Colour. &c. | Notes. |
|---------------------------------------|---|------------|--|----------------|--|
| 12 12 | Ursa Major | W. | | | |
| 12 | " | .. | 3 | | |
| 14 | Leo | .. | 3 | | |
| 14 | " | .. | 2 | | |
| 15 | Canis Minor | .. | 2 | | |
| 15 | " | .. | 2 | | |
| 15 | " | .. | 2 | | |
| 17 | Ursa Major | .. | 3 | | A train. |
| 17 | Ursa Minor | .. | 1 | | |
| 18 | Zenith | .. | | | A train. |
| 18 | Canis Minor | .. | | | A train. |
| 19 | Ursa Major | .. | | | A train. |
| 19 | " | .. | 1 | | A train. |
| 19 | " | .. | 1 | | A train. |
| 20 | Cancer | .. | 1 | | |
| 20 | Orion | .. | | | |
| 20 | Zenith | .. | | | |
| 20 30 | " | .. | 2 | | |
| 21 0 | Ursa Major | .. | | | |
| 21 0 | " | .. | | | |
| 21 50 | Zenith | .. | | | |
| 21 50 | Orion | .. | | | |
| 22 10 | Gemini | .. | | | |
| 22 10 | " | .. | | | |
| 22 40 | Cancer | .. | 1 | Red | |
| 23 0 | Ursa Major | .. | | | |
| 23 15 | Orion | .. | | | |
| 23 30 | Zenith | .. | | | |
| 23 40 | Cancer | .. | 1 | | |
| 23 40 | " | .. | 2 | | |
| 23 40 | " | .. | | | |
| 23 40 | " | .. | | | |
| 24 40 | Draco | .. | 1 | | |
| 24 40 | " | .. | | | |
| 25 0 | " | .. | 2 | | |
| 26 10 | Ursa Minor | .. | 2 | Red | |
| 26 40 | Gemini | .. | 1 | | |
| 26 40 | Ursa Major | .. | | | |
| 27 0 | " | .. | 2 | | |
| 27 0 | " | .. | | | |
| 27 40 | " | .. | | .. | To this time 22 more smaller meteors had been counted. |
| 28 40 | " | .. | 1 | | |

| Approx. Greenwich M.T. h m s | Constellation or Place of Appearance. | Direction. | Magnitude as compared with Star. | Colour. &c. | Notes. |
|---------------------------------------|---|------------|---|----------------|--|
| 12 28 40 | Orion | .. | 2 | | |
| 28 40 | Boötes | .. | 2 | | |
| 29 10 | „ | .. | | | |
| 30 30 | Zenith | .. | | | |
| 30 30 | Zenith | | | | |
| 31 | Leo Minor | .. | | .. | To this time 22 more additional meteors had been counted (between 27 ^m ♂ and 31 ^m ♂). |
| 31 | „ | .. | 1 | | |
| 31 | „ | .. | 1 | | |
| 31 | „ | .. | 1 | | |
| 31 | „ | .. | 1 | | |
| 31 | „ | .. | 1 | | |
| 31 | Zenith | .. | | | |
| 31 | „ | .. | | | |

After this time the numbers increased so rapidly, that it was necessary to suspend all specific observation of them, excepting the counting.

The following table gives an abstract of the numbers :—

| Approx. Greenwich M.T. h m s | Numbers counted in the Interval. | Notes. |
|---------------------------------------|---|---|
| 12 31 0 | | |
| 31 40 | 4 | |
| 31 50 | 1 | In Orion. |
| 31 50 | 1 | In Ursa Major. |
| 32 50 | 3 | In the north. |
| 33 20 | 4 | „ |
| 34 10 | 6 | |
| 35 0 | 4 | |
| 35 30 | 3 | |
| 35 50 | 4 | At this time lightning from a dark bank of cloud on north horizon. |
| 36 50 | 3 | |
| 37 30 | 4 | |
| 38 10 | | 12 smaller counted. |
| 38 30 | 2 | In the zenith. |
| 38 40 | 11 | |
| 39 40 | 11 | |
| 40 40 | 5 | |
| 41 10 | 6 | |
| 41 40 | 8 | |
| 42 10 | 12 | |
| 42 20 | 8 | |

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| Approx. Greenwich M.T. | | | Numbers. counted in the interval. | Notes. |
|------------------------------|----|----|--|--|
| h | m | s | | |
| | 43 | 40 | 11 | |
| | 44 | 40 | 14 | |
| | 45 | 40 | 15 | |
| | 46 | 40 | 24 | |
| | 47 | 40 | 22 | |
| | 48 | 40 | 19 | |
| | 49 | 40 | 38 | |
| | 50 | 40 | 18 | |
| | 51 | 40 | 20 | |
| | 52 | 40 | 30 | |
| | 53 | 40 | 50 | |
| | 54 | 40 | 30 | |
| | 55 | 40 | 22 | |
| | 56 | 40 | 28 | |
| | 57 | 40 | 22 | |
| | 58 | 40 | 30 | |
| | 59 | 40 | 34 | |
| 13 | 0 | 10 | 40 | |
| | 0 | 40 | 30 | |
| | 1 | 40 | 60 | |
| | 2 | 40 | 65 | |
| | 3 | 40 | 80 | |
| | 4 | 40 | 95 | |
| | 5 | 40 | 82 | |
| | 7 | 40 | 106 | At the rate of 53 per minute. |
| | 9 | 40 | 155 | „ 78 „ |
| | 10 | 40 | 123 | „ 123 „ |
| | 12 | 10 | 107 | „ 71 „ |
| | 15 | 40 | 148 | Clouds. |
| | 19 | 40 | 190 | |
| | 23 | 40 | 235 | A large meteor with comet-like appearance in |
| | 28 | 40 | 168 | Orion at this time. |
| | 31 | 40 | 65 | Interrupted by clouds for 20 ^m . |
| | 51 | 10 | 1 | In the zenith; very red. |
| | 53 | 40 | 66 | |
| | 56 | 10 | 21 | |
| 14 | 0 | 0 | 42 | |
| | 2 | 40 | 28 | |
| | 6 | 30 | 28 | |
| | 8 | 10 | 22 | |
| | 9 | 10 | 1 | With a long white train. |
| | 12 | 40 | 42 | |

| Approx. Greenwich M.T. h m s | Numbers counted in the interval. | Notes. |
|---------------------------------------|---|--|
| 14 15 10 | 20 | |
| 16 0 | 1 | Burst in the east. |
| 19 10 | 19 | |
| 24 10 | 28 | |
| 28 10 | 16 | |
| 31 10 | 13 | |
| 35 10 | 16 | |
| 38 40 | 8 | |
| 39 40 | 2 | |
| 40 10 | 2 | |
| 45 10 | 19 | In the west. While recording this number, the room was illuminated by the bursting of a large white meteor near Lyra (S.P.), of which Mr. Lucas caught a glimpse through the window. |
| 50 0 | 19 | |
| 53 50 | 11 | |
| 58 10 | 17 | Wind rising. |
| 15 3 40 | 17 | At this time Mr. Lucas went to the West Terrace, and in the interval before the next recorded time counted the numbers given, 10 in the east and 13 in the west. |
| 10 10 | 23 | 5 in the east, and 6 in the west. |
| 13 40 | 11 | One of them very bright. |
| 20 40 | 11 | |
| 26 40 | 12 | |
| 32 0 | 11 | |
| 39 0 | 11 | |
| 43 40 | 7 | |
| 15 46 20 | 7 | |
| 15 46 20 | 1 | White; in Lyra. |
| 48 40 | 1 | White; in Auriga. |
| 55 20 | 10 | |
| 57 40 | 4 | |
| 16 0 50 | 5 | The wind has increased to the strength of 4. |
| 6 0 | 6 | |
| 9 40 | 2 | From Aldebaran. |
| 9 40 | 3 | In the eastern half of the sky. |
| 13 40 | 3 | One in the east and two in the west. |
| 17 10 | 6 | Two east, and four west. |
| 21 0 | 10 | Four east, and six west. |
| 24 40 | 1 | East. |
| 27 40 | 5 | Three east, and two west. |
| 32 20 | 1 | East. |
| | | The observers (Mr. Quirling and Mr. Lucas) took a rest of nearly 40 minutes. |
| 17 10 0 | | Zodiacal light visible. |
| 13 40 | 7 | |
| 16 40 | 5 | |

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Shower of November 13-14, 18 λ 6.

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| Approx. Greenwich M.T. h m s | Numbers counted in the interval. | Notes. |
|---------------------------------------|---|--|
| 17 18 30 | 1 | 1st mag. ; white, from Draco eastward. |
| 22 40 | 1 | 1st mag. ; blue ; from Leo eastward. |
| 22 40 | 4 | |
| 28 0 | 2 | |
| 28 55 | 1 | 1st mag. ; white ; from Draco westward. |
| 35 0 | 3 | |
| 36 0 | 1 | 1st mag. ; reddish ; from Urs. Maj. northward. |
| 40 10 | 5 | |
| 44 0 | 1 | 1st mag. ; reddish ; from Leo vertical. |
| 48 0 | 2 | 1st mag. ; from Leo. |
| 51 10 | 4 | Through Leo and Gemini. |
| 56 0 | 3 | Through Leo and Boötes. |
| 18 0 0 | 1 | 1st mag. ; in Boötes. |

The chronometer was compared with the transit-clock, and it was found to be 20^s fast on Greenwich mean time. The observed times have all been corrected for this error.

In general Mr. Lucas kept the record of the observations, but, during the time of the greatest numbers, the observers (Mr. Quirling and Mr. Lucas) each counted in his own division of the heavens, Mr. Quirling watching the portion south of the prime vertical, and Mr. Lucas the portion north of the prime vertical.

The whole number of meteors counted throughout the night, was 3087, of which about 2000 fell between 13^h and 14^h. Those which left trains were the brightest, the train remaining visible only for a few seconds in general.

In one particular instance, however, (that at 13^h 23^m 40^s) the train was visible for some minutes. This meteor, which appeared in the belt of *Orion*, was very bright, and left its train apparently attached to ζ *Orionis*, giving to that star the appearance of a comet with a tail of nearly 3° in length, standing out at a position angle of 45°; it then detached itself from the star, keeping up the same route as the meteor, but forming itself into a ball of faint cometic appearance of about 15' in diameter, which grew dimmer and more diffused, and disappeared altogether after a lapse of 4 or 5 minutes, at a distance of nearly 1° from ζ *Orionis*, and at a position angle of about 110°.

In several instances the meteors disappeared for an instant as if hidden by the clouds, and then reappeared, following their former course (generally downwards). This was observed only by Mr. Lucas who was watching towards the North East. The greatest attention was directed towards the eastern

portion of the sky, as it was from this quarter that the display was expected.

It may also be mentioned that as both observers were on the Eastern terrace, a considerable portion of the western sky was hid from their view.

On the Meteoric Shower of 1866, November 13-14.

By the Rev. W. R. Dawes.

The glorious display of the November meteors was seen to great advantage from this station during the night of the 13th, the sky, after a rainy day, having almost entirely cleared by about 8^h. A few meteors were seen in the evening; but no regular watch was commenced till about 11^h. I had two assistants; and, as feeble health forbade my being exposed to the keen W. by N. wind (which formed the only drawback to the pleasure of the exhibition), I took my station with one assistant on the east side of my house, having a good view of nearly the whole of the eastern hemisphere. My other assistant, who was also unable to face the cold blast, I stationed at an upper west window of the house. The only clouds were a few near the northern horizon, and a bank along the western horizon scarcely higher than from 5° to 7°.

At first I intended to note the G.M.T. of the appearance of the most remarkable meteors, and the course each pursued among the stars, with their relative brightness, colour, &c.; and for some time I accomplished this, and will here state the particulars of some of the brightest.

Remarks.

| G.M.T. | | | |
|--------|----|-----|---|
| h | m | s | |
| 11 | 22 | 0 ± | A little south of <i>Rigel</i> ; course due west; long bright train; extinguished at an altitude of 25°; pinkish; brighter than <i>Mars</i> or <i>Sirius</i> ; nearly as bright as <i>Venus</i> at her maximum. |
| 11 | 26 | 0 ± | From <i>Pollux</i> , through <i>Aldebaran</i> , and about 20° beyond; decidedly of a greenish hue. |
| 11 | 45 | 10 | From <i>Mars</i> over the zenith; as bright as <i>Venus</i> at maximum; leaving a long and bright train. |
| 11 | 47 | 0 ± | Very bright; through α <i>Androm</i> . Up to midnight 75 meteors were counted in the eastern hemisphere. |
| 12 | 6 | 30 | From a little south of <i>Procyon</i> to 15° above <i>Sirius</i> . As bright as <i>Venus</i> at maximum. |
| 12 | 21 | 15 | Through κ <i>Orionis</i> ; as bright as <i>Jupiter</i> . |
| 12 | 22 | 40 | Shot a little north of <i>Mars</i> ; brighter than <i>Mars</i> . |
| 12 | 32 | 0 ± | Bright; from β <i>Canis Min.</i> ; through the nebula of <i>Orion</i> . |